



Novel phases in the good old manganites

Significant amount of research has been devoted recently to characterize structural and physical properties of the oxygen-deficient perovskite materials such as the $\text{La}_{1-x}\text{Sr}_x\text{MnO}_y$ system (LSMOy) [1-6]. The understanding of vacancy formation and ordering processes are of fundamental importance in the design, preparation and processing of materials for applications such as solid oxide fuel cell cathodes and oxygen membranes where vacancy formation and mobility are highly desired. We have investigated the formation of vacancy-ordered structures in the Sr-rich end of the LSMOy system. New vacancy-ordered phases with $y=2.5$, 2.6 and 2.714 that show also complex electronic charge and orbital ordering as well as intricate magnetic ordering have been identified for $x=0.7-1$. The formation of vacancy-disordered phases favorable for oxygen permeation has been found to be directly linked to the competition between Mn average charge and the number of vacancies present indicating that the observed vacancy-ordering patterns are formed as a consequence of the specific 4-, 5-, and 6-coordination preferences of Mn^{2+} , Mn^{3+} and Mn^{4+} cations present in these compounds for various values of y . The presentation will be an overview of results obtained during the last three years at MSD's Neutron and X-ray Scattering Group, Intense Pulsed Neutron Source and the Materials Design Lab., Physics Department, NIU where these novel phases were unveiled.

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